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PATENT APPLICATION

ATTORNEY DOCKET NO. 200316546-1

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	**Randy L. Hoffman et al.**	**Confirmation No.:**	**8519**
Application No.:	**10/799,839**	**Examiner:**	**NGUYEN, Dilinh P.**
Filing Date:	**March 12, 2004**	**Group Art Unit:**	**2893**

Title: Semiconductor Device

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on March 9, 2009.

☒ The fee for filing this Appeal Brief is $540.00 (37 CFR 41.20).

☐ No Additional Fee Required.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

☐ 1st Month $130	☐ 2nd Month $490	☐ 3rd Month $1110	☐ 4th Month $1730

☐ The extension fee has already been filed in this application.

☒ (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account 08-2025 the sum of $ 540. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees.

Respectfully submitted,

Randy L. Hoffman et al.

By /Steven L. Nichols/

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In the Patent Application of

Randy L. Hoffman, et al.

Application No. 10/799,839

Filed: March 12, 2004

For: Semiconductor Device

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APPEAL BRIEF

Mail Stop Appeal Brief - Patents
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Sir:

This is an Appeal Brief under Rule 41.37 appealing the decision of the Primary Examiner dated January 9, 2009 (the "final Office Action"). Each of the topics required by Rule 41.37 is presented herewith and is labeled appropriately.

I. Real Party in Interest

The real party in interest is Hewlett-Packard Development Company, LP, a limited partnership established under the laws of the State of Texas and having a principal place of business at 20555 S.H. 249 Houston, TX 77070, U.S.A. (hereinafter "HPDC"). HPDC is a Texas limited partnership and is a wholly-owned affiliate of Hewlett-Packard Company, a Delaware Corporation, headquartered in Palo Alto, CA. The general or managing partner of HPDC is HPQ Holdings, LLC.

II. Related Appeals and Interferences

There are no appeals or interferences related to the present application of which the Appellant is aware.

III. Status of Claims

Under a previous Restriction Requirement, claims 2-5, 8, 9, 12, 13, and 16-57 were withdrawn from consideration. Applicant will be entitled to rejoinder of claims 2-5, 8, 9, 12, 13, 16 and 17 upon the allowance of claim 1. *See* MPEP § 821.04. Consequently, these claims are still at issue in this appeal and are listed in the following Appendix. Claims 18-57 may still be entitled to rejoinder, but are not included in the following Appendix because they do not depend from a claim currently under examination.

Claims 1, 6, 7, 10, 11, 14 and 15 are pending. Claims 6, 7, 10, 11, 14 and 15 all depend, directly or indirectly, from claim 1 and have been indicated as containing allowable subject matter.

Claim 1 stands finally rejected and is the only rejected claim in the application. Appellant now appeals from the final rejection of claim 1. Accordingly, claims 1-17 are presented in the Appendix as being at issue in this appeal.

IV. Status of Amendments

No amendments have been filed subsequent to the final Office Action of January 9, 2009, from which Appellant takes this appeal.

V. Summary of Claimed Subject Matter

The claimed subject matter at issue in this appeal is recited in claim 1. Claim 1 reads as follows.

A semiconductor device, comprising:

a drain electrode (e.g., 112) (*Appellant's specification, p. 3, lines 8-18*);

a source electrode (e.g., 110) (*Appellant's specification, p. 3, lines 8-18*);

a channel (e.g., 108) contacting the drain electrode (112) and the source electrode (110) (320) (*Appellant's specification, Figs. 1A-1F*), wherein the channel (108) includes one or more of a metal oxide including zinc-germanium, zinc-lead, cadmium-germanium, cadmium-tin, or cadmium-lead (*Appellant's specification, p. 8, lines 6-9*); and

a gate dielectric (e.g., 106) positioned between a gate electrode (e.g. 104) and the channel (108) (*Appellant's specification, Figs. 1A-1F*).

VI. Grounds of Rejection to be Reviewed on Appeal

The final Office Action raised the following rejection.

(1) Claim 1 was rejected under 35 U.S.C. § 103(a) as obvious in view of the combined teachings of U.S. Patent No. 6,727,522 to Kawasaki U.S. Patent No. 4,641,167 to Nishizawa ("Nishizawa").

According, Appellant hereby requests review of this rejection in the present appeal.

VII. Argument

(1) Claim 1 is patentable over Kawasaki and Nishizawa:

Claim 1 recites:

> A semiconductor device, comprising:
> a drain electrode;
> a source electrode;
> a channel contacting the drain electrode and the source electrode, *wherein the channel includes one or more of a metal oxide including zinc-germanium, zinc-lead, cadmium-germanium, cadmium-tin, or cadmium-lead*; and
> a gate dielectric positioned between a gate electrode and the channel.

(Emphasis added).

Applicant notes that claim 1 recites a semiconductor device in which the channel includes one or more *metal oxides*, specifically including at least one of "zinc-germanium, zinc-lead, cadmium-germanium, cadmium-tin, or cadmium-lead." Applicant's specification supports this subject matter by stating the following. "Exemplary embodiments include semiconductor devices that contain a multicomponent channel including ... a two-component oxide formed of a zinc-germanium oxide, zinc-lead oxide, cadmium-germanium oxide, cadmium-tin oxide, cadmium-lead oxide." (Applicant's specification, p. 1, line 29 to p. 2, line 4).

In contrast, neither of the cited prior art references teach or suggest the claimed semiconductor device comprising a channel including an oxide from the following list: "zinc-germanium, zinc-lead, cadmium-germanium, cadmium-tin, or cadmium-lead." This subject matter is entirely outside the scope and content of the cited prior art.

According to the Action, Kawasaki teaches a "channel 11 [that] includes one or more of a metal oxide including zinc magnesium oxide $Mg_xZn_{1-X}O$, zinc cadmium oxide $Cd_xZn_{1-x}O$." (final Office Action, p. 2). This, however, is utterly irrelevant because zinc magnesium

oxide and zinc cadmium oxide are not among the oxides recited in claim 1. Consequently, Kawasaki clearly fails to teach or suggest the claimed channel including one or more metal oxides from the list recited in the claimed, namely, "zinc-germanium, zinc-lead, cadmium-germanium, cadmium-tin, or cadmium-lead."

The final Office Action does concede that "Kawasaki et al. do not disclose the channel including zinc-germanium." (final Office Action, p. 3). Consequently, the Action cites to Nishizawa at col. 3, lines 13-23. (*Id.*). According to the Action, this portion of Nishizawa teaches a "channel including zinc-germanium." (*Id.*). This is clearly incorrect.

The cited portion of Nishizawa states the following.

> Those regions of the layer 2 and 4 which will form the channel are doped with an impurity atom which is excited by infrared or far infrared light. The hatched region 9 indicates that region. The region to be doped with the impurity element which is excited by the infrared or far infrared light is selected in accordance with the region of wavelength of light to be detected, and the thickness of the region to be doped may be about the penetration depth of the infrared or far infrared light. Such an impurity element may preferably be gold, mercury, zinc or the like in the case of a germanium substrate and gold or the like in the case of a silicon substrate.

(Nishizawa, col. 3, lines 13-23).

Thus, Nishizawa teaches a channel region formed in a germanium or silicon substrate that is doped with an impurity such as gold, mercury, zinc or the like. Thus, among the possibilities taught by Nishizawa is a germanium substrate doped with zinc. This, however, is not a teaching or suggestion of a zinc-germanium or, more relevantly, a zinc-germanium *oxide*, as the Action seems to conclude.

Nishizawa clearly does not teach, suggest or even mention a metal ***oxide*** used to form the channel. Doping a germanium substrate with zinc produces zinc molecules embedded in germanium. Doping a germanium substrate with zinc does not produce a chemical reaction resulting in zinc-germanium or a zinc-germanium ***oxide*** as recited as one of the options in claim 1.

The Action fails to address how a zinc-doped germanium substrate comes to include a zinc-germanium ***oxide*** as recited in claim 1. Consequently, when claim 1 and the prior art are properly understood, it is clear that neither Kawasaki nor Nishizawa teaches or suggests the claimed channel including one of the expressly listed metal oxides of claim 1.

In response to these arguments, the final Office Action argues that "Applicant has failed to consider as a whole the prior art teachings disclosed by the combining of the references." (final Office Action, p. 4). The final Office Action also notes that "applicant cannot show non-obviousness by attacking references individually wherein the rejection is based on a combination of references." (*Id.*).

In response, Appellant respectfully reiterates that neither of the cited references teach or suggest the claimed channel "wherein the channel includes one or more of a metal oxide including zinc-germanium, zinc-lead, cadmium-germanium, cadmium-tin, or cadmium-lead." Neither of the cited references mentions any of these oxides as a constituent of a channel as claimed.

The fact that Appellant has necessarily had to demonstrate this fact with respect to both of the cited references individually does not mean that Appellant has failed to consider the implications of the proposed combination of prior art references. However, the prior art still does not teach or suggest the claimed "wherein the channel includes one or more of a metal oxide including zinc-germanium, zinc-lead, cadmium-germanium, cadmium-tin, or cadmium-lead."

The final Office Action further states that "the examiner disagrees with applicant's argument because Kawasaki et al. disclose the channel 11 includes one or more of a metal oxide including zinc magnesium oxide $Mg_xZn_{1-X}O$, zinc cadmium oxide $Cd_xZn_{1-x}O$ (fig. 1A,

column 3, lines 33-36)." (final Office Action, p. 5). Again, zinc magnesium oxide and zinc cadmium oxide are not among the oxides recited in claim 1.

The position in the final Office Action appears to be an argument that the zinc magnesium oxide of Kawaski is the same thing as the zinc-germanium oxide or zinc-lead oxide recited in claim 1, or that zinc cadmium oxide is the same thing as the "zinc-germanium, zinc-lead, cadmium-germanium, cadmium-tin, or cadmium-lead" recited in claim 1. Either of these positions is clearly incorrect and unreasonable.

The final Office Action also reiterates that "Kawasaki et al. do not disclose the channel including zinc-germanium. However, Nishizawa discloses a semiconductor device (cover fig.) comprising: a channel (a region between source electrode 6 and drain electrode 8) contacting the drain electrode and the source electrode, wherein the channel including zinc-germanium." (final Office Action, p. 5). However, as demonstrated above, Nishizawa teaches no such thing.

Nishizawa teaches doping a germanium substrate with zinc, which does not produce a chemical reaction resulting in zinc-germanium ***oxide*** as recited as one of the options in claim 1. The final Office Action still fails to address how a zinc-doped germanium substrate comes to include a zinc-germanium ***oxide*** as recited in claim 1.

Under the analysis required by *Graham v. John Deere*, 383 U.S. 1 (1966) to support a rejection under § 103, the scope and content of the prior art must first be determined, followed by an assessment of the differences between the prior art and the claim at issue in view of the ordinary skill in the art. In the present case, the scope and content of the prior art, as evidenced by Kawasaki and Nishizawa, did not include the claimed subject matter, particularly "a channel contacting the drain electrode and the source electrode, *wherein the channel includes one or more of a metal oxide including zinc-germanium, zinc-lead,*

cadmium-germanium, cadmium-tin, or cadmium-lead." Neither of the cited references teach or suggest a channel comprising any of the listed metal oxides.

The differences between the cited prior art and the claimed subject matter are significant because the claimed subject matter provides features and advantages not known or available in the cited prior art. Consequently, the cited prior art will not support a rejection of claim 1 under 35 U.S.C. § 103 and *Graham*. Therefore, for at least the reasons explained here, the rejection based on Kawasaki and Nishizawa of claim 1 should be reconsidered and withdrawn.

In view of the foregoing, it is submitted that the final rejection of the pending claims is improper and should not be sustained. Therefore, a reversal of the Rejection of January 9, 2009 is respectfully requested.

Respectfully submitted,

DATE: May 8, 2009

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VIII. CLAIMS APPENDIX

1. (Previously Presented) A semiconductor device, comprising:

a drain electrode;

a source electrode;

a channel contacting the drain electrode and the source electrode, wherein the channel includes one or more of a metal oxide including zinc-germanium, zinc-lead, cadmium-germanium, cadmium-tin, or cadmium-lead; and

a gate dielectric positioned between a gate electrode and the channel.

2. (Withdrawn) The semiconductor device of claim 1, wherein the channel includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form.

3. (Withdrawn) The semiconductor device of claim 1, wherein the metal oxide includes an atomic composition of metal(A)-to-metal(B) ratio (A:B), wherein A and B are each in a range of about 0.05 to about 0.95.

4. (Withdrawn) The semiconductor device of claim 1, wherein the metal oxide includes one or more of zinc-germanium oxide, zinc-lead oxide, cadmium-germanium oxide, cadmium-tin oxide, cadmium-lead oxide.

5. (Withdrawn) The semiconductor device of claim 4, wherein the metal oxide includes an atomic composition of metal(A)-to-metal(B) ratio (A:B), wherein A and B are each in a range of about 0.05 to about 0.95.

6. (Original) The semiconductor device of claim 1, wherein the channel includes one or more compounds of the formula $A_xB_xC_xO_x$, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ge, Sn, Pb, each C is selected from the group of Zn, Cd, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero integer, and wherein each of A, B, and C are different.

7. (Original) The semiconductor device of claim 6, wherein the one or more compounds of the formula $A_xB_xC_xO_x$ includes an atomic composition of ratio A:B:C, wherein A, B, and C, are each in a range of about 0.025 to about 0.95.

8. (Withdrawn) The semiconductor device of claim 1, wherein the metal oxide includes one or more of zinc-germanium-tin oxide, zinc-tin-lead oxide, zinc-germanium-lead oxide, zinc-cadmium-germanium oxide, zinc-cadmium-tin oxide, zinc-cadmium-lead oxide, cadmium-germanium-tin oxide, cadmium-tin-lead oxide, cadmium-germanium-lead oxide.

9. (Withdrawn) The semiconductor device of claim 8, wherein the metal oxide includes an atomic composition or ratio A:B:C, wherein A, B, and C, wherein A, B, and C, are each in a range of about 0.025 to about 0.95.

10. (Original) The semiconductor device of claim 6, wherein the one or more compounds of formula $A_xB_xC_xO_x$, includes D_x, to form a compound of the formula $A_xB_xC_xD_xO_x$, wherein D is selected from the group of Zn, Cd, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero integer, and wherein each of A, B, C, and D are different.

11. (Original) The semiconductor device of claim 10, wherein the one or more compounds of the formula $A_xB_xC_xD_xO_x$ includes an atomic composition of ratio A:B:C:D, wherein A, B, C, and D, are each in a range of about 0.017 to about 0.95.

12. (Withdrawn) The semiconductor device of claim 1, wherein the metal oxide includes one or more of zinc-germanium-tin-lead oxide, zinc-cadmium-germanium-tin oxide, zinc-cadmium-germanium-lead oxide, zinc-cadmium-tin-lead oxide, and cadmium-germanium-tin-lead oxide.

13. (Withdrawn) The semiconductor device of claim 12, wherein the metal oxide includes an atomic composition or ratio A:B:C:D, wherein A, B, C, and D, are each in a range of about 0.017 to about 0.95.

14. (Original) The semiconductor device of claim 10, wherein the one or more compounds of formula $A_xB_xC_xD_xO_x$ includes E_x, to form a compound of the formula $A_xB_xC_xD_xE_xO_x$, wherein E is selected from the group of Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero integer, and wherein each of A, B, C, D, and E are different.

15. (Original) The semiconductor device of claim 14, wherein the one or more compounds of the formula $A_xB_xC_xD_xE_xO_x$ includes an atomic composition of ratio A:B:C:D:E, wherein A, B, C, D, and E, are each in a range of about 0.013 to about 0.95.

16. (Withdrawn) The semiconductor device of claim 1, wherein the metal oxide includes one or more of zinc-cadmium-germanium-tin-lead oxide.

17. (Withdrawn) The semiconductor device of claim 16, wherein the metal oxide includes an atomic composition or ratio A:B:C:D:E, wherein A, B, C, D, and E, are each in a range of about 0.013 to about 0.95.

18-57. (Withdrawn)

IX. Evidence Appendix

None

X. Related Proceedings Appendix

None